(19)日本国特許庁（ＪＰ）　(12)公開特許公報（Ａ）　(11)特許出願公開番号
特開2002－158194
（P2002－158194A）
(43)公開日　平成14年５月31日(2002.5.31)

(51)Int.Cl.'	識別記号	ＦＩ		テーマコード'（参考）
Ｈ０１Ｌ　21/304	６２２	Ｈ０１Ｌ　21/304	６２２Ｄ	３Ｃ０５８
Ｂ２４Ｂ　37/00		Ｂ２４Ｂ　37/00	Ｈ	
Ｃ０９Ｋ　3/14	５５０	Ｃ０９Ｋ　3/14	５５０Ｚ	

審査請求　未請求　請求項の数10　ＯＬ　（全９頁）

(21)出願番号　特願2000－352443(P2000－352443)

(22)出願日　平成12年11月20日(2000.11.20)

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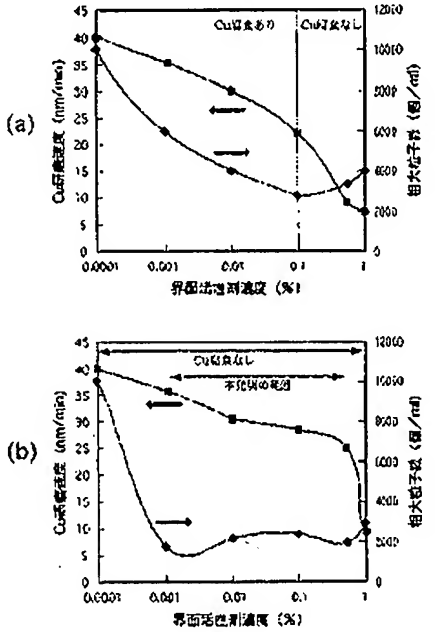
Ｆターム(参考)　３Ｃ０５８　ＣＢ０２　ＣＢ０３　ＣＢ０５　ＣＢ１０　ＤＡ０２
ＤＡ１２　ＤＡ１７

(54)【発明の名称】　化学的機械的研磨用スラリ及び半導体装置の製造方法

(57)【要約】
【課題】　長時間研磨しても研磨速度が著しく低下せず、絶縁膜に損傷を与えない処理を行うことができるＣＭＰ方法を提供する。
【解決手段】　溶媒と、この溶媒に分散した研磨粒子とを有するスラリに、少なくとも１種類の非素有機化合物を添加してウエハなどの半導体基板表面の被研磨面にＣＭＰ処理を施す。スラリには研磨粒子としてＡｌ．Ｃｕ．Ｓｉ等を主成分とする酸化物、炭化物又は窒化物もしくはこれらの混合物や混晶物を用いる。非素有機化合物は、界面活性剤、界面活性作用を有し、疎水部及び親水部を有する試薬もしくは希化剤などを含んでいる。被研磨膜は金属膜或いはこれらの積層膜又はこれらの合金、窒化物、ホウ化物、酸化物から選ばれた材料の膜である。研磨面と研磨パッドとの摩擦が小さく、研磨面のスクラッチを低減し、剥がれを小さくすることが可能になる。Ｃｕ削れ速度も時間の経過に対して一定である。



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the slurry for chemical mechanical polish (CMP:Chemical Mechanical Polishing) for forming DAMASHIN wiring of aluminum, Cu, W, etc. in the semi-conductor substrate carried in DRAM or the high-speed logic LSI, and the manufacture approach of the semiconductor device using this slurry.
[0002]
[Description of the Prior Art] In recent years, in the manufacturing technology of a semiconductor device, detailed-izing of wiring, densification, and multilayering are progressing quickly with high-performance-izing of LSI. Moreover, shrink of the design rule is not only carried out, but installation of a new ingredient is performed actively. For example, development of the interlayer insulation film of low dielectric constant systems, such as the thing and the organic system which use Cu as a principal component, and porosity, etc. is progressing to the wiring material. If especially a CMP technique is applied to the dual DAMASHIN process which embeds and forms wiring or connection wiring in an insulator layer, it can reduce a routing counter, and it can also secure the focal margin of a lithography process by easing unevenness of the wafer outermost surface further. Moreover, since dry etching, such as Cu, is able to form wiring with a difficult ingredient, the CMP technique is an indispensable important technique.
[0003] In the current metal DAMASHIN wiring process, in order to desire a high polish rate in order to raise a throughput, and to form high performance wiring, a CMP process which can attain low scratches, such as the metal sections, such as low erosion (Erosion), such as the metal sections, such as wiring, and an interlayer insulation film, and wiring, and an interlayer insulation film, is desired. By the CMP approach, the metal loss by SHININGU (Thinning) which exaggerated polishing to wiring etc. produces in exaggerated polishing to the metal loss and insulator layer by dishing (Dishing) generated owing to tends to occur, these are doubled, and it is called erosion. A thing, an artificer, etc. by whom a CMP property is decided mainly with a slurry and a scouring pad think. In order that a scouring pad may obtain low erosion, a certain amount of stiffness is required. Controlling erosion by the thing softer than the hardware Pad (IC1000-Pad) marketed at current and Rodel thinks that it is difficult, no matter what slurry it may use. However, although low erosion is realizable in said hardware Pad, it is difficult to lose film peeling resulting from the scratch or scratch by the big and rough particle contained in a slurry, and too much floc, therefore low erosion and low scratch-ization have the relation of a trade-off in the actual condition.
[0004] Therefore, in order to realize both low erosion and a low scratch, it is necessary to aim at the improvement by the side of a slurry so that a scratch may not arise, even if it uses said hardware Pad. When designing a slurry generally, it is necessary to observe two, the deterioration layer or protective coat formed in the surface state of a polished surface, especially a front face, and the polish particle which grinds it. Although a deterioration layer or a protective coat is formed from the oxide of metal, a complex compound, etc., these are important elements to the scratch of the metal section which has the front face in which a high polish rate, low erosion, and a protective coat were formed. Moreover, in case DAMASHIN wiring is formed, it must be cared also to an interlayer insulation film. That is, it is

desirable that they are a low polish rate, low erosion, and a low scratch.
[0005]
[Problem(s) to be Solved by the Invention] As mentioned above, in the manufacture field of semiconductor devices, such as current LSI, CMP is an indispensable process. It sets at the process which forms wiring especially, and is the conventional RIE (Reactive Ion Ething). It is becoming impossible to correspond formation of indispensable wiring structure to the next generation LSI, such as very difficult processing of Cu and metal of a thick film 1 micrometers or more, especially processing of aluminum (aluminum), in a process. In order to solve these, research and development of the DAMASHIN wiring process which embeds wiring at the interlayer insulation film which used CMP are progressing quickly. The technical problem of a current CMP technique is for it to be compatible in the high polish rate which has the relation of a trade-off, and low erosion, and this invention solves this technical problem. It is becoming impossible for processing of ingredients, such as Cu, Ti, etc. with difficult difficult RIE processing of solving, to secure the wiring yield in a RIE (Reactive Ion Etching) process in the manufacturing technology of the conventional semiconductor device. In the case of RIE, it deletes in ** that it is hard to delete, so that a wiring tooth space becomes small, the remainder arises, and between wiring short-circuits. in order to accumulate RIE on the condition of formation of flattening of an insulator layer, and a beer (via) hole one by one to the demand of a routing counter cutback for a manufacture cost cut and to multilayer, a routing counter cutback is difficult -- etc. -- there is a problem.
[0006] In order to solve these things, research and development of the embedding wiring (DAMASHIN wiring) process of having used current and CMP are furthered quickly. As for CMP which uses current metal as the ground film, i.e., the main technical problems of Metal CMP, stabilization of improvement in (1) polish rate, control of (2) erosion, reduction of (3) defects, the CMP property of (4) slurries, and the distributed condition of a polish particle etc. is raised. (1) is required in order to improve a throughput. In grinding the metal of the thick film especially exceeding 1 micrometer, the time dependency of a polish rate arises. Generally, a polish rate is decreasing with time amount. It is ideal, if it is about 3 minutes and 2 micrometers of thickness can be performed in 1st step process. (2) suppresses the value and variation of wiring resistance small in the situation that even formation of wiring is becoming difficult -- if it can kick, it will not become. Since rate-limiting [of the speed of LSI of operation] is especially carried out to RC delay of wiring, lifting of the wiring resistance by the metal loss produced in erosion must be prevented. (3) is concerned with wiring dependability or the yield, and since it does not have to carry out slurry exchange frequently if the stable property is maintainable for a long time in order for (4) to reduce process cost, it can hold down slurry cost.
[0007] As one of the means to solve the trouble of these single strings, the approach of adding a surfactant is in a slurry. However, in the surfactant which has an alkyl group in the non-dense water space of the conventional technique, (1), (2), (3), and (4) are difficult for attaining stabilization, without having the relation of a trade-off and degrading a CMP property, and they have not yet resulted by utilization. It is thought that this cause has the large place depended on the surface activity force of an alkyl group. On the other hand, the ingredient which used Ti, Ta, V, Nb, etc. as the principal component is used for the liner and barrier metal of Cu and aluminum DAMASHIN wiring. Since these are insoluble in acids other than HF, in case CMP of them is carried out to them, there is no suitable reaction agent in them. Therefore, it will be set to a KEMIKARUPUA mechanical subject's CMP. Usually, if it continues shaving the film which can be hard to shave, it will be easy to produce peeling. Since Ta etc. is ** and a hard ingredient that it is hard to delete, when it separates, it will give a blemish for a polished surface violently. Moreover, handling will be difficult for HF and the silica which is a polish particle will melt. Although an alumina does not melt, since there is a problem that the indispensable polish rate of a low dielectric constant-ized insulator layer (Low-K film) will be too quick in a next-generation multilayer interconnection, it is not practical. Even if it is made according to such a situation and grinds for a long time, a polish rate does not fall remarkably, but this invention offers the CMP approach that processing which does not do breakage to an insulator layer can be performed.
[0008]
[Means for Solving the Problem] This invention is characterized by adding at least one kind of fluorine

organic compound to the slurry which has a solvent and the polish particle distributed to this solvent, and performing CMP processing to it in the polished surface-ed of semi-conductor substrate front faces, such as a wafer. The oxide which uses at least one of aluminum, Cu, Si, Cr, Ti, C, and the Fe(s) as a principal component as a polish particle, carbide and nitrides or such mixture, and a mixed-crystal object can be used for a slurry. The fluorine organic compound contains a reagent or a fluoridation agent etc. which has a surfactant and a surface activity operation and has a non-dense water space and a hydrophilic part. Said insulator layer is the insulator layer of the minerals formed using silane system gas and TEOS system gas, and SiO2 which contained fluorine (F) in these for the purpose of making a dielectric constant low. The insulator layer used as a principal component and the dielectric constant epsilon (specific inductive capacity) which it is soft, is weak like organic system porous membrane, is easy to peel, and has hydrophobicity hardly give a damage also to three or less Low-K film. The ground film is film of the ingredient chosen from the film which consists of an ingredient chosen from Cu, aluminum, W, Ti, Mo, Nb, Ta, V, Ru, and Ag, these cascade screens or the alloy which makes these a principal component, the nitride, the boride, and the oxide. It enables it for friction with a polished surface and a scouring pad to be small, to reduce the scratch of a polished surface, and to make peeling small.

[0009] That is, the slurry for chemical mechanical polish of this invention is characterized by having a solvent, the polish particle distributed to this solvent, and at least one kind of fluorine organic compound. You may make it said fluorine organic compound have the fluoro methyl group and the perfluoro-alkyl group in intramolecular as a hydrophobic group. You may make it said fluorine organic compound contain the fluorine used as electrophilicity fluorination. said fluorine organic compound -- perfluoro-alkyl BEDAIN, a perfluoro-alkyl ethylene oxide addition product, perfluoro-alkyl oligomer, perfluoro-alkyl carboxylate, perfluoro-alkyl quarternary ammonium salt, a fluorobenzene system intermediate product, a benzene trifluoride system intermediate product, an aliphatic series system intermediate product, N-fluoro pyridinium salt, N-fluoro pyrrolidone, an N-fluoro-N-alkyl-arene sulfonamide, FClO3, CF3 COOF, and CH3 COOF -- at least -- either -- it is -- you may make . You may make it said fluorine organic compound contain an alkyl group, a ring, or a complex ring. You may make it said fluorine organic compound have either an anion, a cation, nonionic or both sexes at least as a functional group. You may make it said fluorine organic compound concentration be 0.001wt% - 0.5wt%.

[0010] You may make it be the oxide which uses as a principal component at least one element chosen from aluminum, Cu, Si, Cr, Ce, Ti, C, and Fe as said polish particle, carbide, nitrides or such mixture, and a mixed-crystal object. You may make it at least one chosen from ammonium persulfate, potassium persulfate, hydrogen peroxide solution, the second iron of a nitric acid, and the second ammonium cerium of a nitric acid further included as an oxidizer. You may make it at least one of qunaldinic acid, quinolinic acid, a nicotinic acid, picolinic acid, a malonic acid, oxalic acid, a succinic acid, a glycine, an alanine, and the tryptophans included as an additive. The manufacture approach of the semiconductor device of this invention is characterized by having the process which forms a wiring gutter in the insulator layer front face formed on the semi-conductor substrate, the process which makes a metal membrane deposit on said insulator layer containing said wiring Mizouchi section, and the process which removes metal membranes other than said metal membrane which performed chemical mechanical polish using the above-mentioned slurry, and was embedded in said metal membrane front face in said wiring gutter.

[0011]

[Embodiment of the Invention] Hereafter, the gestalt of implementation of invention is explained with reference to a drawing. First, the 1st example is explained with reference to drawing 1 . This invention can attain stabilization of improvement in (1) polish rate which was not obtained, control of (2) erosion, reduction of (3) polishing defects, the CMP property of (4) slurries, and a distributed condition etc. by having used the surfactant which has an alkyl group by adding the surfactant which has a fluoro alkyl group in a non-dense water space to the slurry for chemical mechanical polish. As compared with an alkyl group, the surfactant which has a fluoro alkyl group shows a high surface activity property, and is

little and demonstrates the effectiveness. In this example, laminating formation of a liner and the Cu film is carried out at the insulator layer in which the wiring gutter was formed on the semi-conductor substrate, Cu is first ground by using a liner as a stopper (1st step), and, subsequently CMP processing is performed in 2 (2nd steps) step process of removing the garbage of a liner. And achievement of the process which added the perfluoro-alkyl ethylene oxide nonionic surface active agent to the CMP slurry, and was stabilized in it at 1(Cu touchup) st step which grinds Cu is expected. The fluorine organic compound contains the surfactant, the reagent which has a surface activity operation and contains a hydrophilic part and a non-dense water space, or the fluoridation agent.

[0012] Drawing 1 is a production process sectional view explaining Cu dual DAMASHIN wiring formation. First, the insulator layer 101 formed from silicon oxide etc. on the semi-conductor substrates 100, such as silicon in which the semiconductor device (not shown) was formed, is formed. The contact hole 105 with a depth [for taking the wiring gutter 104 with a depth of 600nm and the semi-conductor substrate 100 with which wiring is formed in the front face of an insulator layer 101, and contact] of 500nm punctures on the base of a wiring gutter 104. Next, about 200nm of TaN liners 102 is made to deposit by sputtering, a seed layer is deposited by sputtering and about 1200nm of remainder is made to deposit the Cu film 103 with plating (drawing 1 (a)). In the interior of a wiring gutter 104 and the contact hole 105, the TaN liner 102 and the Cu film 103 are embedded. Next, CMP processing removes the garbage of the Cu film 103 (drawing 1 (b)). It is made to stop by the TaN liner 101 at this 1st step.

[0013] Here, using the conventional slurry, as an oxidizing agent, it adds to this slurry as ammonium persulfate (1wt%) and an oxidization inhibitor, an alumina (0.5wt) is added to solvents, such as pure water, as qunaldinic acid (0.5wt%) and a polish particle, and Slurry pH is controlled to 9.2 in a potassium-hydroxide water solution. CMP processing is performed to slurry flow:200cc and a scouring pad for 200 seconds on condition that IC1000/SUBA400 (trade name of Rodel, Inc.), (Load DF):300 g/cm2, number of top ring (TR) rotations:100rpm, and number of (Turntable TT) rotations:100rpm using this controlled slurry. Next, touchup (2nd steps) which removes the garbage of the TaN liner 102 using the slurry containing the fluorine organic compound of this invention is performed (drawing 1 (c)). ** since this touchup is the finishing process of wiring -- it is a difficult process that the particle on clearance of the blemish on full clearance of an unnecessary metal, ** wiring section, and an insulator layer, ** wiring section, and an insulator layer, an acid which induces corrosion must be removed etc.

[0014] First, it is necessary to grind a different ingredient from the 103/TaN liner of Cu film / insulator layer 101 with sufficient balance. Since TaN is excellent in chemical resistance, a chemical twist also strengthens the polish force in a mechanical. In this case, polish particle concentration is set up more highly. That is, about 5wt% is common. Although ** is attained by this, if polish particle concentration becomes high, it will become easy to condense a polish particle in a service tank. Furthermore, if an acid, ion, etc. exist in a slurry, condensation is accelerated according to a salting out effect, polish particles solidify and they will tend to be in the condition (formation of a hard cake) of not re-distributing. However, since it becomes polish by the slurry which the big and rough particle mixed, not to mention it takes a blemish, a blemish will be given to reverse. And ** is not attained. Furthermore, since the polish particle concentration in the slurry which contributes to polish falls when a hard cake is formed, rate balance will collapse and the polish itself will become impossible. In order to prevent condensation of a particle, and hard cake-ization, addition of a surfactant is effective, but when the conventional alkyl group is included, effectiveness becomes small if it does not add by high concentration. When it is going to heighten a dispersion effect, there is a problem which polish rate balance cannot collapse and grind. Moreover, addition of a surfactant is dramatically effective also to **. That is, in touchup, a surfactant is a key.

[0015] If the surfactant which has the fluoro alkyl group which is the fluorine system organic compound of this invention is used for a slurry, to the surfactant of the conventional alkyl group, it is little, and since a dispersion effect is heightened, the polish rate balance of an aim can be maintained. Drawing 2 is property drawing explaining the effectiveness which added the surfactant of the slurry of this invention, and is property drawing when property drawing when performing CMP for the surfactant with which drawing 2 (a) has the conventional alkyl chain using a slurry, and drawing 2 (b) perform CMP using the

slurry which added this invention fluorine system compound. The Cu polish rate-surfactant density curve (-**-) and the big and rough particle number-surfactant curve (-<>-) are shown in any property drawing. An axis of abscissa expresses surfactant concentration (wt%), and the axis of ordinate expresses Cu polish rate (nm/min) and the big and rough particle number (a piece/ml). In the conventional case, 200 or more mn/min, 5000 or less big and rough particle numbers (3rd particle diameter: 1 micrometers or more)/ml, and the surfactant concentration that fulfills the conditions of Cu corrosion prevention do not exist, but the polish rate of Cu can be used for it in 0.001 - 0.5wt% and the large range by this invention.

[0016] As an oxidizer, for example, hydrogen-peroxide:1wt% and quinolinic acid:0.1wt%, Add and it considers as the slurry for CMP. as a polish particle -- silica: -- the inside of the slurry which added 3wt% to solvents, such as pure water, -- a perfluoro-alkyl ethylene oxide system surfactant (Nonion) -- 0.025wt(s)% -- CMP processing was performed for 80 seconds on condition that slurry flow:200 cc/min, scouring pad:poly tex (Politex) (trade name of Rodel, Inc.), and DF:300 g/cm2, number of TR revolutions:52rpm, and number of TT revolutions:50rpm using this. Consequently, unnecessary metal was thoroughly removable. Consequently, the wiring yield with a wiring width of face [of 0.2 micrometers] and a die length of 10m was 100%, (1) was attained, defects (a blemish, particle remainder) are also ten pieces / one wafer or less, and (2) and (3) were attained. Of course, the residual particle is also removed thoroughly. The corrosion of Cu was not observed, either. Moreover, the process was able to be carried out to stability for two weeks. It is because the polish particle was able to carry out stable distribution and this prevented hard cake-ization with the surfactant. Furthermore, the effectiveness that erosion can be pressed down small is also checked. In this example, 40nm suppressed erosion at wiring width of face of 50 micrometers, and 80% of wiring coverage. With the conventional technique, it was 85nm.

[0017] When the surface active agent which has the alkyl group of the conventional technique is used, it is difficult to maintain polish rate balance and to prevent condensation-ization of a polish particle. However, according to this invention, such a problem was solvable by adding the fluorine system organic compound beyond 0.001wt%. In this example, although explained using the Nonion (nonionic) surfactant of a fluorine system as a fluorine system organic compound, even if it uses the fluorine system surfactant which has the hydrophilic part of the potential of a polish particle, and same electric potential, the same effectiveness is acquired.

[0018] Next, the 2nd example is explained with reference to drawing 3 and drawing 4 . Drawing 4 is a production process sectional view explaining Cu DAMASHIN wiring formation. In this example, in case CMP of the Cu thick film is carried out, Cu DAMASHIN wiring with which the process stabilized using the slurry which added perfluoro-oligomer is attained is formed. Although there is a process which grinds Cu of a thick film 1 micrometers or more in the production process of semiconductor devices, such as LSI, lowering of a polish rate poses a problem (refer to drawing 3). With the polish time amount in CMP processing, it is property drawing in which being able to delete and showing relation with an amount Cu, an axis of abscissa can delete polish time amount (second) and an axis of ordinate Cu, and drawing 3 expresses the amount (nm). Continuous lines are the ultimate lines which show the CMP property of this invention, and dotted lines are the ultimate lines which show the conventional CMP property. For example, although 500nm can be deleted in the polish for 60 seconds, only 800nm can be deleted if it grinds for 120 seconds at a stretch. 60 to 120 second will be able to be deleted and an amount will decrease with 300nm. This is considered for the reactant and slurry component (mainly polish particle) which are generated during polish to adhere to a scouring pad, and to produce MEZUMARI. Therefore, each moderate hydrophilization processing is needed.

[0019] Moreover, to form Cu DAMASHIN wiring using the insulator layer of the low dielectric constant-ized (Low-K) ingredient of an organic system, when dealing with an inorganic insulator layer, caution is above required to a defect and peeling. Moreover, the insulator layer of an organic system is hydrophobicity in many cases. And when a semi-conductor substrate front face is hydrophobicity, there is also a problem to which particle tends to adhere. Therefore, the hydrophilization on an insulator layer front face, a resultant, a slurry component, and the front face of a scouring pad serves as the point. Next,

the process flow at the time of performing CMP to Cu film of thickness with reference to drawing 4 is explained. First, the insulator layers 201, such as silicon oxide, are formed on the semi-conductor substrates 200, such as silicon. Pattern formation of the wiring gutter 204 with a depth of 800nm is carried out to the front face of this insulator layer 201. An insulator layer 201 is an organic system insulator layer, and is soft here, and it is weak, and is the film which is easy to separate. Moreover, insulator layer 201 the very thing is hydrophobicity. Subsequently, 1400nm sequential deposition of 10nm and the Cu film 203 is carried out for the TaN liner 202. The Cu film 203 forms a seed layer by the sputtering method, and forms the remainder by plating (drawing 4 (a)).

[0020] Next, CMP processing removes the garbage except the part embedded in the wiring gutter 204 of the Cu film 203 and the TaN liner 202 (drawing 4 (b)). In this example, 1 step process of making polish by the CMP approach completing at a time is used. A slurry component adds oxidizing agent:ammonium persulfate (1wt%), oxidization inhibitor:qunaldinic acid (0.5wt%), polish particle:colloidal silica (1wt%), an alanine (0.3wt%), a regulator, etc. to solvents, such as pure water, adds perfluoro-oligomer (0.025wt%) as a surfactant which is a fluorine system organic compound, and controls pH to 9 with a potassium-hydroxide water solution. And slurry flow:200 cc/min, a scouring pad: CMP processing was performed for 150 seconds on condition that IC1000/SUBA400, DF:300 g/cm2, number of TR revolutions:100rpm, and number of TT revolutions:100rpm. In this invention, an unnecessary metal of the whole wafer surface was able to be ground by CMP processing for 150 seconds. However, when the surfactant which has the conventional alkyl group was used, even if it performed CMP for 300 seconds, unnecessary metal was not able to be removed thoroughly (refer to drawing 3).

[0021] Since that the conventional technique was not able to remove metal had the inadequate hydrophilization on a resultant and the front face of a scouring pad, it can delete on a scouring pad front face, and further, a surfactant will be accumulated on a scouring pad and dregs will be considered to be because for the surfactant concentration under polish to become [things and] high seemingly, if the bank and a **** ball are in the condition of being easy to be generated. When it is neutrality electrically, in order that the hydrophilization on the front face of a scouring pad or the hydrophilization of a hydrophobic ingredient may not commit electric attraction especially, it can delete and dregs (for example, the silica was charged in minus (-) and Cu complex is charged in plus (+)) are smoothly discharged from a polished surface. In this invention, like an organic system insulator layer or a porosity insulator layer, it is soft and weak, and also about a defect and a scratch, without giving a damage also to the film which is easy to separate, since friction under polish (torque-sensor current value of a table motor) is also small, it is surmised also to peeling that it is an advantageous direction. furthermore -- although the corrosion prevention effectiveness of Cu is expectable since a surfactant protects Cu which oxidized -- the fluorine system organic compound of this invention -- also setting -- more than 0.001wt% -- the effectiveness was checked by adding.

[0022] Here, if the fluorine system organic compound beyond 0.5wt% is added, effect will appear in the ease of the ability to delete of a surface protective coat, and a polish rate will fall to it remarkably. It is thought that it is because the rate of the cause of the surfactant of a protective coat increases. Therefore, as for the operating concentration of a surfactant, considering as less than [0.5wt%] is desirable. In this example, although explained using a fluorine system Nonion (nonionic) surfactant as a fluorine system organic compound, even if it uses the fluorine system surfactant which has the hydrophilic part of the potential of a polish particle, and same electric potential, the same effectiveness is acquired.

[0023] Next, the 3rd example is explained. This example explains how to grind TaN using a fluorination agent. And it applies to the touchup process of Cu DAMASHIN wiring formation as well as the 1st example. As the conventional technique described, CMP which made the chemical force of Ta effective is difficult for eye backlash which is inactive. However, only to fluorine, it is activity very much. An artificer used to observe this fluorine. Namely, it aims at the fluoridation of TaN in this invention. A fluoro pyridine is used as a fluoridation agent. A fluoro pyridine is the organic system compound which was suitable when Cu and Ta lived together in order that a pyridine may stick to Cu and may protect Cu front face after F dissociated by the fluoridation of Ta. What melted the fluoro pyridine (0.2wt%) and

the silica (0.5wt%) to the ethylene chloride solvent was used for the slurry component. Polish conditions performed CMP processing for 45 seconds on condition that slurry flow:200 cc/min, scouring pad:IC1000/SUBA400, DF:300 g/cm2, number of TR revolutions:100rpm, and number of TT revolutions:100rpm.

[0024] thereby -- the mechanical in a polish particle subject -- since it is not necessary to perform rich CMP, polish particle concentration can be reduced. From a viewpoint of a scratch and peeling resistance, it is an advantageous direction. Moreover, with the conventional technique, in order to improve the evasion and mechanical effectiveness of a scratch by the big and rough particle in the case of touchup, it needed to grind with the fricative big software pad. However, since the slurry which made polish particle concentration low by this invention is used and the activity of a hard pad is also attained, there is a very big merit from a viewpoint of controlling erosion.

[0025] Next, the 4th example is explained with reference to drawing 5 . Drawing 5 is a production process sectional view explaining aluminum DAMASHIN wiring formation. This example explains how to perform CMP of aluminum to a pyridine ring using the compound which has a sulfonic acid as a fluoro methyl group and a functional group. The role of a fluorine system organic compound aims at the protective coat formation on the front face of aluminum, and immobilization (namely, anchor effect) in the scouring pad of a polish particle using the hydrophobicity of a fluoro methyl group, and the hydrophilic property of a sulfonic acid. An anchor effect means raising polish effectiveness (polish rate) by fixing a polish particle in a scouring pad. First, the insulator layers 301, such as silicon oxide, are formed on the semi-conductor substrates 300, such as silicon. Patterning of the wiring gutter 304 with a depth of 300nm is carried out to this insulator layer 301 front face. An insulator layer 301 is soft like the organic system film, and it is weak here, and is the film which is easy to separate. Next, 15nm and about 800nm of aluminum film 303 are deposited for the Nb liner 302 by sputtering (drawing 5 (a)).

[0026] Next, at a stretch, the unnecessary aluminum film 303 and the Nb liner 302 are ground by CMP at a stretch, and are removed. The slurry component of this invention used for this example adds oxidizer:ammonium persulfate (2wt%), oxidization inhibitor (surface protective coat formation):quinolinic acid (0.6wt%), a fluoro pyridine salt (0.5wt%), and a polish particle:alumina (3wt%) to solvents, such as pure water, and is obtained. pH of a slurry is controlled by 5. Since the alumina is charged in +, it is attached to the sulfone radical configurated in the pyridine (- electrification). In a slurry, it is expected that a hydrophobic, strong polish particle group is formed. And CMP processing for 150 seconds was performed on condition that slurry flow:200 cc/min, scouring pad:IC1000/SUBA400, DF:300 g/cm2, number of TR revolutions:100rpm, and number of TT revolutions:100rpm using this slurry (drawing 5 (b)). Since a scouring pad is hydrophobicity when the slurry of this example is supplied on a scouring pad (turntable) at the time of polish, it will get used well with a hydrophobic particle group. Consequently, polish rate 500 nm/min of aluminum is obtained in this invention.

[0027] When there is no fluoro methyl group which is the conventional technique on the other hand and a pyridine sulfonic acid is used, a polish rate is as small as 220 nm/min. Since the polish rate of this invention improves more than twice, process time amount is shortened. Moreover, the decrease of a scratch and the decrease of a residual particle which low concentration-ization of a polish particle of is attained since a polish particle works efficiently, consequently are produced in a polished surface are expected. Moreover, there is also an advantage of reduction of slurry cost. Moreover, it was checked that the pyridine which stuck to aluminum front face has the effectiveness of the corrosion prevention of aluminum, and it is effective in suppressing erosion small further. In this example, although the anion is used for the hydrophilic part of a fluorine system organic compound, even if it uses the fluorochemical surfactant which has the hydrophilic part of the potential of a polish particle, and reverse potential, the same effectiveness is acquired.

[0028] In addition, it does not pass over the above-mentioned example to an example, and this invention is not limited to these. For example, fluorine system surface active agents may be an anion, a cation, and nonionic (Nonion). Moreover, these may be mixed and used. These may be mixed and used also about a fluoridation agent and a fluoro pyridine salt, and concomitant use with a fluorine system surfactant or

surfactants, such as an alkyl chain, is also possible. It can change suitably also about the rotational frequency of the load at the time of polish (DF), a top ring (TR), and a turntable (TT) etc. In addition, it is variously deformable in the range which does not deviate from the summary of this invention.
[0029] Next, the CMP processing which carries out this invention with reference to drawing 6 is explained. The grinder (turntable (TT)) 1 with the pivotable CMP equipment which carries out CMP processing using the slurry of this invention is attached. On the grinder 1, the scouring pad 2 which grinds wafers, such as silicon, is stuck. A wafer is arranged in a scouring pad 2 and the location which counters, and is being fixed to the adsorption cloth and template which were attached in the adhesive disk (top ring (TR)) 3 with the vacuum or the water flare. It connects with the actuation shaft 4 and a top ring (TR) 3 rotates the actuation shaft 4 by the motor. A slurry is supplied between the wafers and scouring pads 2 which were fixed to the top ring 3. Thus, CMP of a wafer is performed. Drawing 6 is the perspective view of the CMP equipment which carries out CMP processing of the wafer actually using the above-mentioned slurry. For example, the wafer fixed to the top ring 3 attached in the actuation shaft 4 rotated by about 30 revolutions per minute is pushed by the predetermined load (DF), and while the slurry supplied from the slurry delivery pipe 38 drawn from the slurry tank is dropped at a processing point, CMP polish is performed to the scouring pad 2 stuck on the grinder 1 which rotates by about 30 revolutions per minute.
[0030]
[Effect of the Invention] As mentioned above, a high polish rate is attained by that of CMP **** using the slurry containing a fluorine organic compound, and the CMP property that the decentralization by which the polish particle was stabilized is attained is improved, maintaining polish rate balance, and this invention can form metal DAMASHIN wiring of high performance with still less erosion.

[Translation done.]